and adjusts the screen size of the mountain correctly to half size, canceling the effect of the viewer moving 50% closer to the screen. The mountain is seen by the viewer as unaltered, as he would also see in real world, since the mountain is still approximately 10 miles away (less three feet) but the image is viewed from half the original distance to the screen. Without detecting the viewer's position, the mountain's apparent size would have doubled, as discussed above.

[0134] At the same time, a small bush in the foreground is left unaltered by the IPD since the viewer's motion in fact results in the real distance to that bush being halved and the unaltered projected image should look twice as big, at half the distance, precisely as it would if it were a real bush. Additionally, since the bush is now quite close, a system using the IPD, for example the VAR system, allocates some extra graphics resources to render more visible details in each leaf of the bush, and the like, to render a closer view of the bush, since the user is now closer and expects to see more detail. This is made possible by the dynamic resolution control feature of the IPD. Possibly, as the viewer gets very close, the system may actually project a shadow of the viewer over the bush. Such rendering would further enhance the realism experienced by the viewer. The realism is further supported by the IPD due to substantial lack of fixed pixel size, pixel position, pixel orientation, or scan patterns. The IPD may render and display all objects in view in the natural looking detail with few or no obvious visual artifacts. An important point to note is that the IPD is independent of a game controller, buttons, or keys to adjust the image. The IPD may adjust the image automatically based on the position camera and the field of view of the viewer.

[0135] FIG. 6C shows an embodiment of a IPD projection onto a tilted screen. IPD **402** may project an image onto screen **114** when centerline **650** of projection is substantially perpendicular to the surface of screen **114**. In this configuration, symmetrical projection lines **642** and **644** are substantially equal in length due to the symmetry of projection with respect to screen **114**. In one embodiment, IPD **402** may project the image onto screen **640** having an angle not perpendicular to centerline **650**. In this configuration, asymmetrical projection lines **646** and **648** are substantially different in length due to the asymmetrical configuration of screen **640** with respect to IPD **402**. Because asymmetrical projection lines **646** and **648** have different lengths, the flight time of tracer beam pulses **418** (see FIG. 4B) will be different when the tracer beam is projected along the asymmetrical projection line **646** than when the tracer beam is projected along the asymmetrical projection line **648**. This difference in flight time may be detected by the IPD and used to adjust the projected image and avoid image distortion due to a "stretching" effect of a tilted screen.

[0136] The stretching effect is caused by geometric projection of a line segment onto a plane having an angle α with respect to the line segment. The length of the projected line segment, L_p=L/Cos α, where L is the length of the line segment. In this case, L_p>L, causing the stretching of the line segment. Similarly, any other shape projected on a tilted screen is also stretched by the same factor of 1/Cos α. The same adjustments done for tilted screen **640** may be applied to a projection surface with small surface irregularities and/or angles, such as a fabric with wrinkles or angled walls, in a piece-wise fashion. This ability of IPD to use the tracer beam feedback and automatically adjust the projected image in

real-time enables projection of images onto uneven and irregular surfaces with substantially reduced or eliminated distortions.

[0137] FIG. 7A shows an embodiment of a mobile device with an embedded IPD. Mobile device **702** may be any of a variety of mobile computing devices, such as mobile phones, PDA's, laptop PC's, and the like. The operation of IPD is similar to that described above. Because IPD technology is small by nature, using miniaturized solid state components such as LED light sources **104**, MEMS (Micro Electronic and Mechanical Systems), such as scanner **110** (see FIG. **1**), processor **116**, and the like, and the actual screen, such as screen **114**, where the image is projected is generally external to IPD **100**, IPD is suitable for housing in small physical computing devices with little or no loss of screen size and/or displayed image quality. One limitation of small mobile computing devices is availability of sufficient power to run light sources for high intensity projection. In one embodiment, an AC power adapter may be used to provide additional electrical power for brighter or longer duration projections using mobile device **702**. Software applications that need high quality GUI on modern mobile devices and can benefit from the IPD technology include electronic mail (e-mail), video games, mobile web pages, and the like. The outputs of such software applications may be displayed using a IPD as a projected image **704**, instead of using the generally small and low resolution screens available on such devices.

[0138] FIG. 7B shows another embodiment of a mobile device with an embedded IPD and a head-mounted position sensor. In one embodiment, position sensor **602**, shown in FIG. **6**, may be implemented as an ear-mounted device that communicates wirelessly with the IPD embedded in mobile computing device **702** to provide wireless position feedback **708** to the IPD, as described above with respect to FIG. **6**. Displayed image perspective is adjusted as user **604** moves around with respect to screen **114** and/or mobile device **702** when set in a stationary position.

[0139] FIG. 8A shows a flow diagram of one embodiment of a high level process of generating an image using a IPD. The process starts at block **880** and proceeds to block **882** where a tracer beam is projected onto a projection screen along a pseudorandom scanline trajectory. As described above, the tracer beam may include intense, short-duration light pulses, such as IR pulses, that may be imperceptible to human vision but may be easily detected by a detector. The process moves to block **886**.

[0140] At block **886**, the tracer beam is detected. Various detection schemes may be used that detect the screen position of each pulse on the pseudorandom scanline, such as 2-D CCD arrays, beam-folding optical detectors, and the like. Several screen positions corresponding to the tracer beam pulses are detected. In one embodiment, a sliding window with a width of N screen positions may be used to detect the tracer beam. The N screen positions may subsequently be used to predict the trajectory of the scanline. The process proceeds to block **888**.

[0141] At block **888**, a portion of the scanline trajectory that is not yet projected by the IPD is predicted based on the N screen positions detected at block **886**. For example, a curve fit algorithm may be used to extrapolate and determine the next M screen positions on the scanline. The process proceeds onto block **890**.

[0142] At block **890**, stored image pixels or generated graphics corresponding to the next M screen positions are